

**Study Guide**

For use with pages 403–409

**GOAL** Find and interpret slopes of lines.**VOCABULARY**

The **slope** of a line is the ratio of the line's vertical change, called the **rise**, to its horizontal change, called the **run**.

**EXAMPLE 1** Finding Slope

A ladder is leaning on a house. Its base is 6 feet from the house and it is resting on the house at a height of 22 feet. Find its slope.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{22}{6} = \frac{11}{3}$$

**Answer:** The ladder has a slope of  $\frac{11}{3}$ .

**Exercise for Example 1**

1. A railing has a rise of 15 feet and a run of 10 feet. Find the slope of the railing.

**EXAMPLE 2** Finding Positive and Negative Slope

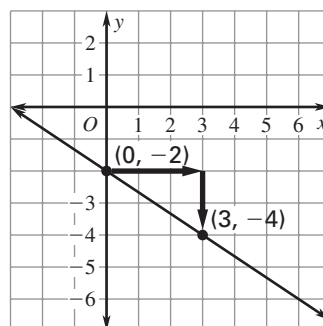
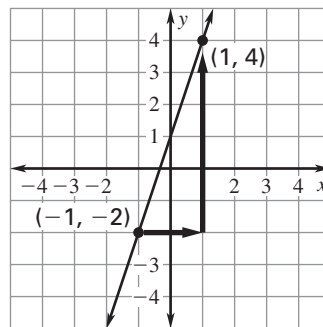
Find the slope of the line shown.

$$\begin{aligned} \text{a. } m &= \frac{\text{rise}}{\text{run}} = \frac{\text{difference of } y\text{-coordinates}}{\text{difference of } x\text{-coordinates}} \\ &= \frac{4 - (-2)}{1 - (-1)} \\ &= \frac{6}{2} \\ &= 3 \end{aligned}$$

**Answer:** The slope is 3.

$$\begin{aligned} \text{b. } m &= \frac{\text{rise}}{\text{run}} = \frac{\text{difference of } y\text{-coordinates}}{\text{difference of } x\text{-coordinates}} \\ &= \frac{-4 - (-2)}{3 - 0} \\ &= \frac{-2}{3} \\ &= -\frac{2}{3} \end{aligned}$$

**Answer:** The slope is  $-\frac{2}{3}$ .

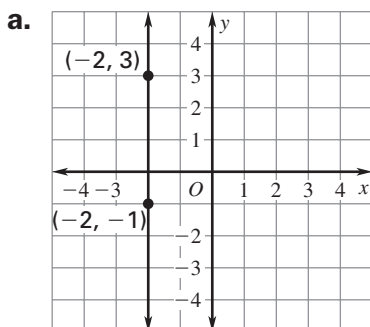


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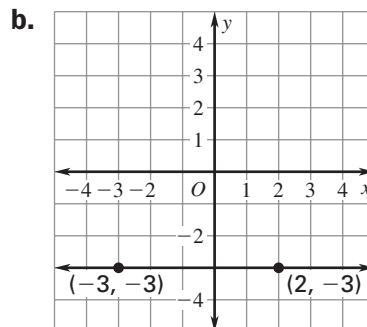
## EXAMPLE 3 Zero and Undefined Slope

Find the slope of the line shown.



$$\begin{aligned} m &= \frac{\text{rise}}{\text{run}} = \frac{\text{difference of } y\text{-coordinates}}{\text{difference of } x\text{-coordinates}} \\ &= \frac{3 - (-1)}{-2 - (-2)} \\ &= \frac{4}{0} \quad \text{Division by zero is undefined.} \end{aligned}$$

**Answer:** The slope is undefined.



$$\begin{aligned} m &= \frac{\text{rise}}{\text{run}} = \frac{\text{difference of } y\text{-coordinates}}{\text{difference of } x\text{-coordinates}} \\ &= \frac{-3 - (-3)}{2 - (-3)} \\ &= \frac{0}{5} = 0 \end{aligned}$$

**Answer:** The slope is 0.

## EXAMPLE 4 Interpreting Slope as a Rate of Change

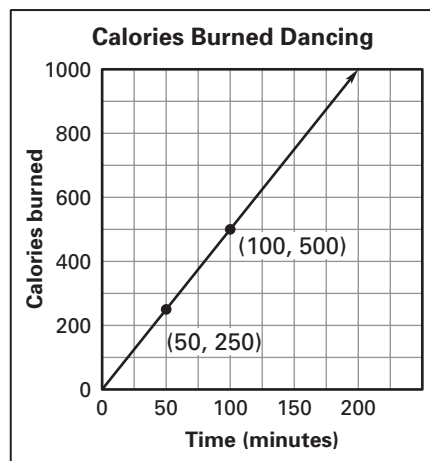
The graph shows the Calories burned by dancing as a function of time. The slope of the line gives the number of Calories burned per unit of time, which is the *rate of change* in Calories burned with respect to time. Find the Calories burned per minute.

### Solution

Use the points (50, 250) and (100, 500) to find the slope of the line.

$$\begin{aligned} m &= \frac{\text{rise}}{\text{run}} = \frac{\text{difference of } y\text{-coordinates}}{\text{difference of } x\text{-coordinates}} \\ &= \frac{500 \text{ Cal} - 250 \text{ Cal}}{100 \text{ min} - 50 \text{ min}} = \frac{250 \text{ Cal}}{50 \text{ min}} = 5 \text{ Cal/min} \end{aligned}$$

**Answer:** Dancing burns 5 Calories per minute.



### Exercises for Examples 2–4

In Exercises 2–5, find the slope of the line through the given points. Tell whether the slope is *positive*, *negative*, *zero*, or *undefined*.

2.  $(-3, 3), (2, -1)$     3.  $(5, 6), (-3, 6)$     4.  $(-3, -3), (9, 7)$     5.  $(3, 1), (3, -5)$

6. You burn 108 Calories playing basketball for 12 minutes and 135 Calories playing basketball for 15 minutes. Draw a graph of Calories burned as a function of time. What information can you obtain from the slope?